

## FACILITATING PROXIMITY SERVICES

### FIELD

**[0001]** The invention relates generally to mobile communication networks. More particularly, the invention relates to facilitating proximity services and, in particular, enabling reliable local device-to-device (D2D) advertising.

### BACKGROUND

**[0002]** It is foreseen that user terminals, which are carried by users located in a specific area, may receive advertisements from other devices in the area. The advertisements may be transmitted to the user terminal via a device-to-device (D2D) communication. This advertisement between two closely located devices may be seen as part of proximity based services (ProSe). Key issues in such D2D based local hyper-advertising services of ProSe may include, for example, security and reliability.

### BRIEF DESCRIPTION OF THE INVENTION

**[0003]** According to an aspect of the invention, there are provided methods as specified in claims **1**, **9** and **12**.

**[0004]** According to an aspect of the invention, there are provided apparatuses as specified in claims **14**, **22**, **25** and **27**.

**[0005]** According to an aspect of the invention, there is provided a computer program product as specified in claim **28**.

**[0006]** According to an aspect of the invention, there is provided a computer-readable distribution medium carrying the above-mentioned computer program product.

**[0007]** According to an aspect of the invention, there is provided an apparatus comprising processing means configured to cause the apparatus to perform any of the embodiments as described in the appended claims.

**[0008]** According to an aspect of the invention, there is provided an apparatus comprising a processing system configured to cause the apparatus to perform any of the embodiments as described in the appended claims.

**[0009]** According to an aspect of the invention, there is provided an apparatus comprising means for performing any of the embodiments as described in the appended claims.

**[0010]** Embodiments of the invention are defined in the dependent claims.

### LIST OF DRAWINGS

**[0011]** In the following, the invention will be described in greater detail with reference to the embodiments and the accompanying drawings, in which

**[0012]** FIG. 1 presents a cellular communication network, according to an embodiment;

**[0013]** FIGS. 2, 4 and 5 show scenarios applicable for advertisement service, according to some embodiments;

**[0014]** FIGS. 3, 7 and 8 show methods, according to some embodiments;

**[0015]** FIG. 6 illustrates a time line with validity periods of security keys, according to an embodiment; and

**[0016]** FIGS. 9 to 11 illustrate apparatus according to some embodiments.

### DESCRIPTION OF EMBODIMENTS

**[0017]** The following embodiments are exemplary. Although the specification may refer to “an”, “one”, or

“some” embodiment(s) in several locations of the text, this does not necessarily mean that each reference is made to the same embodiment(s), or that a particular feature only applies to a single embodiment. Single features of different embodiments may also be combined to provide other embodiments.

**[0018]** Radio communication networks, such as the Long Term Evolution (LTE) or the LTE-Advanced (LTE-A) of the 3<sup>rd</sup> Generation Partnership Project (3GPP), are typically composed of at least one base station (also called a base transceiver station, a radio network controller, a Node B, or an evolved Node B, for example), at least one user equipment (UE) (also called a user terminal, terminal device or a mobile station, for example) and optional network elements that provide the interconnection towards the core network. The base station may be node B (NB) as in the LTE, evolved node B (eNB) as in the LTE-A, a radio network controller (RNC) as in the UMTS, a base station controller (BSC) as in the GSM/GERAN, or any other apparatus capable of controlling radio communication and managing radio resources within a cell.

**[0019]** The base station may connect the UEs via the so-called radio interface to the network. In general, a base station may be configured to provide communication services according to at least one of the following radio access technologies (RATs): Worldwide Interoperability for Microwave Access (WiMAX), Global System for Mobile communications (GSM, 2G), GSM EDGE radio access Network (GERAN), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS, 3G) based on basic wideband-code division multiple access (W-CDMA), high-speed packet access (HSPA), LTE, and/or LTE-A. The present embodiments are not, however, limited to these protocols.

**[0020]** FIG. 1 shows a communication network where embodiments of the invention may be applicable. A base station **102** may be used in order to provide radio coverage to the cell **100**. For the sake of simplicity of the description, let us assume that the base station is an eNB. In the case of multiple eNBs in the communication network, the eNBs may be connected to each other with an X2 interface, as specified in the LTE. The eNB **102** may be further connected via an S1 interface to an evolved packet core (EPC) **110**, more specifically to a mobility management entity (MME) and to a system architecture evolution gateway (SAE-GW). The MME is a control plane for controlling functions of non-access stratum signaling, roaming, authentication, tracking area list management, etc., whereas the SAE-GW handles user plane functions including packet routing and forwarding, evolved-UMTS terrestrial radio access network (E-UTRAN) or LTE idle mode packet buffering, etc.

**[0021]** Still referring to FIG. 1, the eNB **102** may control a cellular radio communication links established between the eNB **102** and each of terminal devices **104A** and **104B** located within the cell **100**. These communication links marked with solid arrows may be referred as conventional communication links or as cellular communication links for an end-to-end communication, where the source device transmits data to the destination device via the eNB **102**. Therefore, the user terminals **104A** and **104B** may communicate with each other via the eNB **102**. The terminal device may be a terminal device of a cellular communication system, e.g. a computer (PC), a sensor, a laptop, a palm computer, a mobile phone, or any other user terminal (UT) or user equipment (UE) capable of communicating with the cellular communication network.